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No. 66

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USSR REPORT

MATERIALS SCIENCE AND METALLURGY

No. 66

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BRIEFS

ALUMINUM PRODUCTION--The output of aluminum at the Tadzhik Aluminum Plant was increased almost one-third. New production has become operational here. Modern technology permits not only a reduction of the specific electric power consumption, but also provides high purity of the metal. The plant--the head enterprise of the Southern Tadzhik Territorial Industrial Complex--continues to the expanded. An additional large shop is now being prepared for installation. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 49, Dec 79 p 6] 6521

[54]

SUPERPURE ALUMINUM--Dushanbe--The first tens of kilograms of superpure aluminum have been produced at the Institute of Chemistry of the Tadzhik Academy of Sciences. It contains only 0.0005 percent microimpurities. The new metal is qualitatively produced by the multiple recrystalization method. And the raw material was the "winged metal" smelted by the Tadzhik Aluminum Plant. The scientists of Tashkent, reported Vice-President of the Academy of Sciences of the republic P. Solozhenkin, are working on the problem of increasing the output of metals of special purity. [Text] [Moscow IZVESTIYA 3 Nov 79 p 3] 6521

[54]

USSR UDC 669.71:539.37

THE EFFECT OF ADDITIVES ON THE SUPERPLASTICITY OF ALUMINUM

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 48 No 1, Jul 79 pp 194-196 manuscript received initially 29 Mar 78, in final form 21 Jun 78

KUZ'MIN, S. L., LIKHACHEV, V. A., MYSHLYAYEV, M. M., NIKONOV, YU. A., and SEN'KOV, O. N., Leningrad State University imeni A. A. Zhdanov

[Abstract] The aluminums tested included technically pure (99.5%) and pure (99.999%) aluminum, and duraluminum with 4.1% Cu, 1.5% Mg, 0.6% Mn, 0.5%, 0.5% Si, 0.3% Zn and up to 1.5% other impurities. Samples were subjected to torsion and tension was measured by electron microscope. The results showed that in pure and technically pure aluminum grain size was not affected by torsion, and monocrystals and polycrystals showed similar superplasticity. A decrease in the size of structural elements decreased the degree of deformation before failure. Figures 3; references 7: 5 Russian, 2 Western.
[31-12131]

USSR UDC 669.71'721'5

OPTIMIZATION OF THE COMPOSITION OF THE Al-Mg-Zn CASTING ALLOYS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 9, 1979 pp 41-42

DOLZHANSKIY, YU. M., POSTNIKOV, N. S. and POBEZHIMOV, P. P., All-Union Scientific Research Institute of Aviation Materials

[Abstract] Al-Mg alloys have been used as corrosion-resistant materials in marine environments. The addition of Zn to the system permits the development of a single phase -solid solution. This increases the strength characteristics and allows a reduction in the light elements to (Mg+Zn) $<$ 10%. Additions of traces of titanium, manganese, and beryllium improve the structure, decrease the susceptibility of oxidation, and increase the mechanical properties. A mathematical model was set up to study the changes in mechanical properties (Y_1) as a function of the % Zn (X_2) and % Mg (X_1). Values of X_1 ranged from 6 to 11%; and those of X_2, from 0.5 to 3.5%. The alloy also contained 0.1% of Ti, Mn, and Be. The optimum mechanical properties ($\sigma_B \simeq 40$ kg/mm^2, $\sigma_{\alpha 2} \simeq 30$ kg/mm^2, and $\delta \approx 10\%$) were obtained for 6 to 8% Mg and 1.5 to 3% Zn. Figures 2; references 6 (Russian).
[26-12027]

USSR UDC 669.715

CREEP AND HEAT RESISTANCE OF ALUMINUM ALLOYS FOR PISTONS

Lvov FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 15 No 5, 1979 pp 105-106 manuscript received 30 Nov 78

CHERNOV, V. YU., LENTS, R. O., BONDAREV, A. A. and RABKIN, D. M., Institute of Electrical Welding imeni Ye. O. Paton Academy of Sciences SSR, Kiev

[Abstract] Creep in Silumins was determined at 260, 300 and 360° C; these temperatures were regarded as typical for the area of the first compression ring and the combustion chamber. Samples of AL25 and AL30 aluminum alloys were prepared, age hardened for 12 hours, then subjected to temperature and load variables. No variations in creep for the two alloys was noted. Less stretch (1.5-3%) was recorded at 260 and 300°C (11-13%). The rate of oxidation also was related to temperature variations. Figures 2; references 2 (Russian).
[42-12131]

USSR UDC 620.178.2:669.725:620.184.6

ON THE QUESTION OF DETERMINING THE FRACTURE DUCTILITY OF BERYLLIUM USING DATA OF FRACTOGRAPHIC INVESTIGATIONS

Lvov FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 15 No 5, 1979 pp 82-86 manuscript received 21 Mar 77

KANCHEYEV, O. D. and POLITIKO, S. K.

[Abstract] To study practical problems relating to the coefficient of fracture ductility, hot-extruded rods of distilled and technical metal-beryllium containing about 0.9% O_2 and no more than 0.3 to 0.5% metallic impurities were tested for fatigue at a frequency of 2000 cycles/minute in a compression-stretching cycle based on $1 \cdot 10^6$ cycles. Fractographic analysis showed that in the temperature range of -196 -- +300°C, unstable growth of cracks was related to the development of macrofacets. Crystalline defects developed in the material during the course of fatigue tests, bringing a reduction in the coefficient of fracture ductility. At temperatures above 300°C the nature of defects changed from transcrystalline to intercrystalline. Further experimental data are necessary to establish a correlation between results of fractographic analysis and other tests. Figures 5; references 12: 6 Russian, 6 English.
[42-12131]

BRIEFS

STEEL PARTS PRODUCTION--The electrode approaches the steel part, a dry crackle is heard and thousands of fiery filament discharges occur on the surface of the article. The temperature reaches 10,000 degrees within a second. The steel becomes darker before one's eyes, being covered with a thin layer of solid compounds. The metal is bombarded by "mini-lightning" by a device developed by scientists of the Institute of Problems of Materials Science of the Ukrainian SSR Academy of Sciences, the Institute of Applied Physics of the Moldavian Academy of Sciences and the Penza Polytechnical Institute. These "mini-lightnings" are capable of splitting a molecule of one material and of tightly "stitching" them to the surface of another. Since the refractory compounds used as the electrodes are distinguished by especially high hardness and wear resistance, ordinary steel acquires a reliable coating. As indicated by practice, it increases the durability of steel parts by a factor of 3-4. [Text] [Moscow SOVETSKIY VOIN in Russian No 14, Jul 79 p 47] 6521

[54]

USSR UDC 621.762

THE EFFECT OF SATURATION AND THERMAL AGING ON THE INSULATING PROPERTIES OF ALUMINUM OXIDE PLASMA COATINGS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 39-42 manuscript received 30 Oct 78

KARPINOS, D. M., DMITRIYEV, V. S. and ZIL'BERBERG, V. G., Institute of Problems of Material Science, Academy of Sciences Ukrainian SSR

[Abstract] Local delamination, cracking and destructive isolation experienced with previous electrical isolation methods led to the development of a method of plasma deposition based on a 150-200 mkm layer of aluminum oxide. The surface was first roughened with metal shot, then saturated in a vacuum with ceramics and corundum, orthosilicic acid with corundum, and an orthosilicate material. Results showed good adhesion qualities using this method after prolonged thermal action and a series of heating and cooling applications of 20-859-20° C at 5-5.5 degree/minute. Figures 4; references 6: 5 Russian, 1 English.
[43-12131]

USSR UDC 539.216.1

EFFECT OF BRITTLE COATINGS ON THE STRENGTH OF BORON FIBERS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 5, Sep-Oct 79 pp 82-86 manuscript received 14 Feb 78

USTINOV, L. M., Moscow

[Abstract] An analysis was made of the effect of SiC, B_4C and BN coatings as well as brittle layers in AlB_2 and TiB_2 composites on the strength of boron fibers and the nature of change of the coatings. Boron fibers coated with the first three coatings should fracture with a critical thickness of 1--2 microns (SiC, B_4C) and tenths of a micron (BN). The critical thickness for the brittle layers in combination with boride fibers was equal to tenths and even hundredths of a micron. The relationship of borsic (B-SiC) fibers (boron coated with SiC) to coating thickness was established and found to be satisfactory with the theoretical relationship to the critical thickness of SiC being 1.5 microns. Figures 2; references 9: 4 Russian, 5 Western.
[25-6368]

USSR UDC 669.058:669:293

APPLICATION OF TITANIUM CARBIDE COATINGS TO IRON AND STEEL SURFACES

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No 10, 1979 pp 35-37

LOSKUTOV, V. F., BYAKOVA, A. V. and SAPON, V. I., Kiev Polytechnic Institute

[Abstract] Considering that carbide coatings enhance hardness and resistance to wear and corrosion in steel products, the vacuum deposition of titanium carbide coatings on the surface of 15 x 10 x 15 mm specimens of Armco iron and 20, 25, U8A, and U12A carbon steels was experimentally investigated. The process was carried out in the presence of CCl_4, granules of polyethylene, and pure titanium powder (200 μm grain size) at 10^{-1} mm Hg. The CCl_4 was added because at high temperatures it dissociates into carbon and free chlorine: the chlorine interacts with the Ti powder to form gaseous chlorides, thus assuring delivery of Ti atoms to the specimen surface. Granules of polyethylene were added to increase the carbonizing power of the mix. The optimal amounts of polyethylene and CCl_4 were found to be 5 g and 5 cc, respectively, per square meter of the area saturated, inclusive of the interior surface of the reaction chamber. The optimal temperature and time of deposition were found to be 950-1000°C and 3-5 hrs, respectively. The wear resistance of the products so coated was found to be 3-7 times as high as that of the non-coated products. Hardness and corrosion resistance (in 3% NaCl, 10% Na_2CO_3, 30% KOH, and 0.1 n.H_2SO_4 solution) also were then greater. Figures 2; references 8 (Russian).
[23-1386]

USSR UDC 621.357.7

ON THE INCLUSION OF CERAMIC MICROPOWDERS IN NICKEL COATINGS. REPORT 6: EFFECT OF FINE-DISPERSE PARTICLES ON THE STRUCTURE OF CERNIK COATINGS

Vil'nyus TRUDY AKADEMII NAUK LITOVSKOY SSR in Russian, Ser B No 5(114), 1979 pp 29-34 manuscript received 10 Apr 78

RAMANAUSKENE, D. K., YURYAVICHENE, M. I. and SKROBOTSKAYA, V. V., Institute of Chemistry and Chemical Technology, Academy of Sciences Lithuanian SSR

[Abstract] Microparticles of electrocorundum (α-Al_2O_3), boron carbide (B_4C) and silicon carbide (SiC) were included in a nickel coating matrix, for a comparative study of the embedment kinetics and the resulting cernik

structure. Examination under a JEM-5Y electron microscope and electronographic analysis, with single-stage carbon replicas and palladium shading produced in a vacuum apparatus, indicate that the embedment mode depends on the electrical properties of the inclusion material. The morphology of a nickel matrix is altered by microparticles with an electrical surface activity (SiC) and even more so by microparticles with some electrical conductivity (B_4C), by way of ingrowth with formation of crystallite clusters which inhibit the growth of oriented nickel crystals and increase the surface roughness. Figures 3; references 16: 6 Russian, 10 Western.
[53-2415]

USSR UDC 628.357.7

CAUSES OF INTERLINKAGE BETWEEN Ni-SiC COATINGS AND AN ALUMINUM ALLOY

Vil'nyus TRUDY AKADEMII NAUK LITOVSKOY SSR in Russian, Ser B No 5(114), 1979 pp 21-27 manuscript received 21 Mar 78

FROLOVA, F. P., ZHITKYAVICHYUTE, I. I. and MIKAYLENE, YE. S., Institute of Chemistry and Chemical Technology, Academy of Sciences Lithuanian SSR

[Abstract] A study was made of the effect of heat treatment at 200°C for up to 200 hours on cast AK18 aluminum alloy with a zinc undercoating on the etched surface and with two nickel overcoatings, the preliminary nickel layer having been deposited from a special-purpose electrolyte and the elastic final nickel layer having been deposited from a Watts electrolyte first containing and then without any disperse particles of silicon carbide. Microsections of the resulting 5-layer (Al, Zn, Ni, Ni-SiC, Ni) specimens were structurally examined under a Neophot-2 optical microscope, with an EP-100 electronograph (in both "transmission" and "reflection" modes), and with a JXA-50 x-ray microanalyzer. Furthermore, the distribution profiles of all three metals were determined and the bond strength between coating and base metal was measured in a tensile testing machine. The results indicate that heat treatment causes interdiffusion of all three metals and formation of solid solutions, especially during the first few hours. Prolongation of the heat treatment does not enhance the bond, but oxidation of the zinc layer prior to deposition of nickel coatings causes a decrease in the final bond strength. Figures 4; references 7 (Russian).
[53-2415]

USSR UDC 621.793.7.001

ADHESION STRENGTH OF DETONATION COATINGS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 9, Sep 79 pp 79-83 manuscript received 19 Oct 78

KORNEV, A. D. and LIVSHITS, M. I., Dnepropetrov Chemical Technology Institute

[Abstract] The effect of horizontal, vertical and radial movement on the adhesive strength of coatings applied by the detonation method was studied. Three experiments were carried out where in one the horizontal and vertical movements of a cassette containing the samples being coated were studied. In the second experiment the effect of rotary motion was studied and in the third one the parts being coated were stationary. Results showed that the third experiment produced by best coatings because in the first two experiments the motion of the samples caused the coatings to have a peripheral zone with weak bonding strength. Figures 2; references 4 (Russian).
[24-6368]

USSR UDC 669.014.018.96:669.295'71'28'296:546.281.261

INVESTIGATION OF THE STRUCTURE AND PHASE COMPOSITION OF THE INTERACTION ZONE IN A VT9 TITANIUM ALLOY-SILICON CARBIDE FIBER COMPOSITE

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 15 No 9, Sep 79
pp 1668-1671 manuscript received 21 Sep 78

Zaytsev, B. G., GUZEY, L. S., SOKOLOVSKAYA, YE. M. and SHULEPOV, V. I.,
Moscow State University imeni M. V. Lomonosov

[Abstract] Results are presented from studying the structure and phase composition of the zone of interaction (ZI) in a composite made from VT9 titanium alloy and SiC fibers which was produced by hot pressing of a mixture of the granulated alloy and fiber at 950-970°C. The ZI was found to contain the same phases that are present in the Ti-Si phase diagram: $TiSi_2$, TiSi and Ti_5Si_3. When the composite was annealed at 800-1200°C, it was noted that the growth rate of the Ti_5Si_3 phase increased from a ratio of 1:1, with the $TiSi_2$ phase, to 2:1 at 1200°C. The mechanism of SiC fiber interaction with the Ti-base matrix was deduced to be the fact that the content of alloying elements in the VT9 was small whereupon these elements, with the exception of Zr, had a lesser affinity for carbon and silicon then titanium. Therefore the interaction of SiC with the matrix was mainly determined by its interaction with Ti. With carbon being the most mobile element, at the instant of interaction in the matrix zone a layer of TiC is formed next to the fiber. Then as Si and C diffuse through this layer, the more stable TiC will be enlarged as carbon causes the layer to increase in thickness while the silicon penetrates deeper into the ZI by diffusion to form silicide phases. Figures 1; references 16: 7 Russian, 9 Western.
[49-6368]

USSR UDC 532.6

USING THE ION BOMBARDMENT METHOD TO ENHANCE THE ADHESION OF METAL FILMS TO THE SURFACE OF A GLASS-CARBON COMPOSITE MATERIAL

Moscow IVUZ. CHERNAYA METALLURGIYA in Russian No 7, 1979 pp 100-102
manuscript received 30 Oct 78

DIGILOV, M. YU., KOSTIKOV, V. I. and PAVLOV, YU. A., Moscow Institute of Steel and Alloys

[Abstract] Ion bombardment drives recoil atoms of the film material into the substrate, thus forming a transition layer. Considering that most metal coatings adhere poorly to carbon materials, the possibility of using this method to assure firm coating of the SU-1500 glass-carbon composite (GCC) was investigated. Specimens of GCC were annealed in vacuo at 3000°C and vacuum-sprayed with films of tin, molybdenum, and silver in a VUP-5 type vacuum chamber with a nitrogen trap in a vacuum of $5 \cdot 10^{-5}$ mm Hg. They were then bombarded with P^+ ions in a vacuum of $4 \cdot 10^{-6}$ mm Hg (ion energies 150-200 keV, doses 10^{12}-10^{16} ions/cm^2). Needle-scratch tests demonstrated that, compared with unbombarded specimens, the strength of adhesion of the coatings on the ion-bombarded specimens was tens of times greater. This is apparently due to the formation of a transition zone between the metal coating and the GCC, owing to:
1) penetration of substrate by the film's recoil atoms colliding with the bombarding ions; and 2) the accelerated diffusion of film atoms into the substrate owing to the radiation defects caused by the bombardment. Figures 2; references 6: 3 Russian, 3 Western.
[177-A--1386]

USSR UDC 669-494:669.295

ON THE SELECTION OF A TITANIUM MATRIX FOR COMPOSITE MATERIALS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 5, Sep-Oct 79 pp 132-135

CHUNIKHINA, L. L., GUZEY, L. S. and SOKOLOVSKAYA, YE. M., Moscow

[Abstract] A study was made of the simultaneous effect of alloying a titanium matrix with aluminum, molybdenum and zirconium on the rate of interaction of these alloys in a titanium alloy-silicon carbide fiber composite. After the composite had been produced by hot pressing in a vacuum at 850-1200°C under a pressure of 10 MN/m^2 there was no detectable

transition zone. Micro-x-ray spectral analysis also showed no reaction zone. Samples were then isothermally annealed at 1200°C (0.5, 2 and 8 hours), 800°C (50, 200, 700 and 1000 hours) and 600°C (350 and 1200 hours). At 600°C the incubation period starts after 350 hours. At 800°C an intermediate reaction zone builds up after 200 hours at a thickness of 2--3 microns. In 700 hours this zone width is 3.5--6.5 microns thick. Equations are provided to show the width of the reaction zone after treating at 1200°C. It was determined that increasing the concentration of alloying elements, while staying in the alpha+beta-region slows down the matrix-fiber interaction very little so that in selection of matrix composition special attention should not be given to the rate of interaction but to the mechanical and physical properties of the investigated composite. Figures 2; references 10: 7 Russian, 3 Western.
[25-6368]

USSR UDC 622.32.658.58.004.18

INCREASING THE DURABILITY OF COMPOSITE MATERIALS WITH A GRANULAR TUNGSTEN CARBIDE BASE BY THERMAL HARDENING

Lvov FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 15 No 5, 1979 pp 95-97 manuscript received 11 Jan 78

BELOUSOV, V. YA., Ivano Frankovsk Institute of Petroleum and Gas

[Abstract] To explain the phenomenon of declining durability after tempering in water as temperature increases, phase analysis of the components of the MNMTS-60-20-20 alloy was made with samples tempered at 600°C and aged at 400°C. Nickel and manganese content in the granules was 71 and 19% respectively, but at the boundaries 50-52% nickel and 30-32% manganese was found. A study of the mechanical properties indicated that the durability of the alloy increased after the segregation of the enriched nickel-manganese compound, which was complete after 8-12 hours of age hardening. Before selecting the material of the coating it is necessary to consider the load under which the coating will operate. Figures 3.
[42-12131]

USSR UDC 669-419:539.374

FEATURES OF CRACK DEVELOPMENT IN LAYER COMPOSITES AND THEIR EFFECT ON FRACTURE ENERGY CAPACITY

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 5, Sep-Oct 79 pp 120-124 manuscript received 21 Apr 79

GUZ', I. S., MILESHKIN, M. B. and GAZOV, V. I., Khar'kov

[Abstract] Results are presented from an investigation of the kinetics and micromechanism of fracture during the impact bending of a crystallized eutectic Ni_3Al-Ni_3Nb and a 45 steel + M3 copper bimetal. In the eutectic composite crack propagation occurs mainly by three types: 1) at right angles to the plates with no traces of interphase fracture; 2) at right angles to the plates with the presence of small local stratifications; and 3) significant stratifications. For the bimetal there were four zones of fracture: 1) ductile fracture in the copper layer; 2) initial ductile fracture of the steel; 3) fracture at the bimetal interface; and 4) mixed fracture modes in the steel. The effect of stratification on fracture energy capacity of layer materials is more substantial when it leads to an increase in the work expended to bend the second layer and to a change in the fracture mechanism (increase in the work expended to fracture the second layer). In the nickel composite, multiple stratification did not yield any significant increase in impact strength. Figures 5; references 3 (Russian).
[25-6368]

SYNTHETIC CAST IRON PRODUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 33, Aug 79 p 14

[Article by P. Mishin, director of the Experimental-Production Complex of NPO Tulachermet, S. Koshelev, chief engineer of the Experimental-Production Complex, B. Krasavin, chief metallurgist of the ZIL Association, and G. Petrov, chief of the Central Metallurgical Laboratory of ZIL: "A New Type of Cast Iron--Synthetic"]

[Text] Blast furnaces smelt two main types of products: conversion and foundry pig iron. The first of them is sent for refining to steel in converters and open hearth furnaces, while the second is used for production of ingots in cupolas at machine building plants. Strict requirements are placed on the latter, which conversion pig iron does not meet. At the same time blast furnace operators are very much interested in stopping the production of foundry pig iron and total conversion of furnaces to smelting conversion pig iron. This may bring many economic advantages--the productivity of blast furnaces is reduced by 25 percent every time a transition is made for smelting foundry pig iron and the coke consumption increases by 20 percent.

Specialists have already been involved for a decade in study of methods of using conversion pig iron in machine building. The conclusion in general terms reduces to the following: yes, replacement of foundry pig iron by conversion pig iron is essentially possible, but only if a number of technical measures are implemented.

The fact is that conversion pig iron is characterized by low silicon content. Therefore, a special silicon-containing additive—ferrosilicon—is used to produce quality castings from it. All the components in the cupola charge should be weighed carefully. And after melting, the metal must be sent to a special large-capacity furnace (mixer) for equalization of the chemical composition of the pig iron. In this case the mixer should be equipped with an electric heater.

As one can see, the use of conversion pig iron in machine building requires implementation of technical measures related to large capital expenditures.

They are needed to increase the capacity of plants which produce silicon-containing additives, for organization of production and equipping existing foundries with weighing devices and electric furnaces.

Nevertheless, the given variant is preferable. According to the evaluation of specialists, the saving from the use of conversion pig iron in casting production comprises approximately four million rubles with regard to all expenditures calculated per million tons of metal. However, the experience of plants that have converted to the use of conversion pig iron (and there are such enterprises) indicates that insignificant, but inevitable deviations of the production process during mass production lead to a sharp increase of rejected castings. Nevertheless, in the final analysis the saving is reduced to a minimum. How is this so?

Having carefully studied the existing situation, specialists of the Scientific Production Association Tulachermet and the ZIL Association proposed a method to kill two birds with one stone: that is, to provide the machine builders with high-quality cast iron with simultaneous smelting of only conversion pig iron at metallurgical plants. The process of saturating it with the necessary quantity of silicon outside the blast furnace was developed. We shall not touch on the research, experiments and tests here. We shall say only that it was possible to produce metal with high casting properties. By analogy with chemistry, the specialists called this cast iron synthetic.

Several methods of smelting it have now been developed and are already being used in the blast furnace of Tulachermet. The basis of them is smelting the conversion pig iron in the blast furnace, to which the silicon-containing additives, specifically ferrosilicon, are added upon release from the furnace to the spout. To reduce silicon losses, the additives are introduced at specific periods and are pulverized to the necessary dimensions prior to feeding.

Let us emphasize that synthetic cast iron has high quality such as that needed by foundry workers. It has been used for several years already at the Automotive Plant imeni Likhachev. Consumption of it has reached 80,000 tons annually. They have refused to use ordinary foundry pig iron at ZIL.

Some increase of ferrosilicon production is required to organize output of synthetic cast iron (as, incidentally, with other versions of converting machine building plants to conversion pig iron). It becomes possible in this case to free the blast furnaces from smelting foundry pig iron, their capacities are used much better and it is possible to save a large amount of scarce coke.

To stop smelting of foundry pig iron in blast furnaces and to convert them to production of synthetic pig iron, Minchermet [Ministry of Ferrous Metallurgy] of the USSR should be concerned about increasing ferrosilicon production at ferroalloy plants.
[56-6521]

6521
CSO: 1842

BRIEFS

METAL CASTING--Workers of the Mogilev branch of the Physicotechnical Institute of the Belorussian SSR Academy of Sciences have developed a new method of casting hollow parts from ferrous and nonferrous metals and alloys. The molten metal is fed into a crystallizer. The crystallizer is intensively cooled by water and the outer contour of the part to be smelted is rapidly formed to it. The liquid melt fills the crystallizer, which maintains the calculated hardening rate of the metal. The intensity of heat dissipation at different moments of shaping the casting can be easily varied. Thus, it is possible to produce parts with given structure and physicomechanical properties. The yield of suitable products reaches 95 percent and the strength of the parts is increased 1.5-2 times. The achievement of the Belorussian scientists makes it possible to mechanize and automate foundry work. [Text] [Minsk SOVETSKAYA BELORUSSIYA, 10 Oct 79 p 2] 6521

[54]

USSR UDC 621.039.532.21

EFFECT OF NEUTRON IRRADIATION ON GRAPHITE ALLOYED WITH SILICON AND BORON

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 15 No 9, Sep 79
pp 1684-185 manuscript received 31 Jan 78

VIRGEL'YEV, YU. S., NAKARCHENKO, YE. I., KUROLENKIN, YE. I. and PEKAL'N, T. K.

[Abstract] The effect of neutron irradiation on siliconized and borosiliconized graphite was studied in relationship to the change in dimensions of the parts being tested. Low-temperature irradiation (70°C) of ordinary and siliconized graphite showed that the relative change of dimension was greater in the latter. Also, when there is 50-70 wt % silicon carbide in the siliconized graphite there is a higher radiation growth of the graphite. This was also true for irradiation at 200°C. When the content of boron carbide reaches almost 20% there is a noticeable tendency of samples to undergo radiation compression (shrinkage) and an extremum which is explained by the presence of two simultaneous processes. The first process involves the formation of large intermediate dislocation loops in the boronized graphite while the second process consists of the formation of a structural (vacancy) porosity filled with helium which comes from splitting the B^{10} isotope during irradiation. The helium promotes crushing of the hard matrix by the "swelling" it creates, which is greater the higher the boron content. Irradiation at 540 and 750°C also revealed the shrinkage effect in boronized graphite and increased strength when subjected to a flux of $2 \cdot 10^{20}$ neutron/cm^2. Figures 2; references 5: 3 Russian, 2 Western.
[49-6368]

USSR UDC 621.78:669.715

FEATURES OF THE HEAT TREATMENT OF AL9 AND AL34 ALUMINUM ALLOYS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No 10, 1979 pp 58-59

VASILEVSKIY, KH. G. and POSTNIKOV, N. S.

[Abstract] The possibility of increasing the pre-quench temperature, reducing the homogenizing time, and improving the precision of aging of cast AL9 and AL34 aluminum alloys (both containing <0.1% each of titanium, zirconium, and boron) was investigated. Two-stage pre-quench heating (1 hr at 535°C and 1 hr at 545°C) was found to maximize the strength of these alloys and reduce in half their homogenizing time. Two-stage aging (with the first-stage temperature, 195-200°C, being higher than the second-stage, 150-175°C) also enhances the strength of these alloys, and the high-temperature first-stage aging causes the dissolution of the Guinier-Preston zones forming in the course of prior natural aging, and thus prevents the decrease in strength. References 2 (Russian).
[23-1386]

USSR UDC 621.78:669.715

HEAT TREATMENT OF HIGH-STRENGTH PELLETIZED ALUMINUM ALLOY

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No 9, 1979 pp 43-44

FEDOROV, V. M., YELAGIN, V. I., SIZOVA, R. M. and SOKOLOV, A. S.

[Abstract] Stepwise heating of granular Al-Cu-Mg and Al-Zn-Mg alloys for fabrication of castings with subsequent quenching leads to an improvement in the strength properties, especially the yield limit, in comparison with single-stage heating. The strengthening of such alloys was explained by the separation of the alluminides of the refractory metals, formed during the breakdown of the supersaturated solid solutions of these metals in aluminum during heating and deformation. The starting material was comprised of 2.0 mm pellets having the composition: Mg, 3.5%; Zn, 10%; Cu, 2.0%; Cr, Zr, 0.6%; Be, 0.005%; Al, remainder. This material was briquetted and sintered into rods 12 mm in diameter. Heating for 1 hour at 400°C leads to a decrease in the number of soluble phases and to further breakdown in the solid solution of the refractory metals, which significantly increases the crystal lattice parameter of the solid solution. Increasing

the time to 10 hours at 400°C does not change the number of dispersed secondary phases of the refractory metals. Increasing the heating time at 400°C to 20 hours leads to a coagulation of the secondary "intermetallides" of the refractory metals and, as a consequence, to the subsequent reduction in the strength properties and plasticity. After the complete heat treatment in the two-stage procedure, the strength was 37 kg/mm^2 as compared with 31 kg/mm^2 for the single-stage process.
References 3 (Russian)
[26-12027]

USSR UDC 621.762.4.045:621.763.4.045

ISENTROPIC COMPACTION OF FIBROUS AND COMPOSITE MATERIALS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 30-34 manuscript received 30 Mar 78

MANUKYAN, N. V. and MINASYAN, V. Ts., Yerevan Polytechnical Institute

[Abstract] Copper fibers 0.05, 0.08, 0.10 and 0.13 mm in diameter were compressed and then annealed in a hydrogen medium at 750°C. Then the effects of compaction were analyzed. The diameter of fibers was found to be of importance only at slow rates of speed; when other conditions were equal small-diameter fibers were found to be preferable. Composite materials based on PZh2M iron powder were similarly treated and analyzed, at rates of 40-140 m/sec. These samples were reinforced with steel fibers. Calculations indicated that isentropic compaction is related to the compression wave and the kinetic energy of the shell. Wave compaction of the copper fibers at a speed of 80 m/sec was 5-8 percent; the remaining compaction was attributed to the kinetic energy of the shell. Figures 4; references 5: 4 Russian, 1 English.
[43-12131]

USSR UDC 621.792.5:669.0.18.45-138.8

COMPACTING OF POROUS ZIRCONIUM DIBORIDE AND TITANIUM DIBORIDE POWDER BRIQUETS DURING SINTERING

Yerevan PROMYSHLENNOST' ARMENII in Russian No 9, Sep 79 pp 36-39

PANKEVICH, A. P., Candidate of Technical Sciences, GASPARYAN, L. A., engineer

[Abstract] Activated sintering of refractory powder materials eliminates the need for hot pressing and generally improves the manufacturing technology of powdered material products. A study was made of the compacting phase of the process involving ZrB_2 and TiB_2 powders prepared by either the carbothermal method (at the All-Union Scientific Research Institute

of Refractory Metals and Hard Alloys and at the Donetsk Plant of Chemical Reactants) or the borocarbide method (at the Institute of Problems of Material Sciences, Academy of Sciences Ukrainian SSR). Specimens of these powders were ground, mixed, soaked in a benzene solution of rubber, cold pressed under 1 ton/cm^2 and vacuum sintered at a heating rate of 30-40°C/hour. The results of kinetic measurements indicate that almost nonporous (98-99% density) briquets can be produced at relatively low sintering temperatures (1600-1750°C) in a short time (15-30 min), if the initial powder contains adequate amounts of iron and chromium, lowering the shear viscosity and thus facilitating the mass transfer process. The presence of gaseous iron and chromium vapor during sintering, as revealed by mass-spectrometry and x-ray structural analysis, does not seem to adversely affect the shrinkage. Figures 1; references 4 (Russian).

USSR UDC 536.46.546.832

AN INVESTIGATION OF THE REACTIVE PROPERTIES OF VARIOUS FORMS OF CARBON DURING SYNTHESIS OF TITANIUM CARBIDE BY THE SHS METHOD

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 6-10 manuscript received 29 Dec 78

SHKIRO, V. M., BOROVINSKAYA, I. P. and MERZHANKOV, A. G., Department of the Institute of Chemical Physics, Academy of Sciences USSR

[Abstract] Cylindrical pressed mixtures of stoichiometric carbon and titanium, with several types of carbon were used, and compression was done in an argon medium. Results showed that with increased structure of the carbon the speed of combustion and completeness of transformation declined. Heat treatment of the PM-15 carbon soot at 2100°C in a vacuum brought increased density but no change in dispersion. The specific surface value of the carbons used had no effect on their reactive properties; rather, structural, energy and chemical factors were involved. Figures 2; references 21: 18 Russian, 1 Czech, 2 English. [43-12131]

USSR UDC 621.762

AN INVESTIGATION OF THE SURFACE OF A HIGH-DISPERSION TITANIUM NITRIDE BY THE METHOD OF X-RAY PHOTOELECTRONIC SPECTROSCOPY

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 1-5 manuscript received 26 May 78

SHUL'GA, YU. M. and TROITSKIY, V. N., Department of the Institute of Chemical Physics, Academy of Sciences USSR and the Institute of New Chemical Problems, Academy of Sciences USSR

[Abstract] Titanium nitride obtained by oxygen reduction of $TiCl_4$ in a nitrogen plasma stream was annealed in a quartz ampule in a regulated oven at 10^{-5} mm Hg. After cooling, X-ray photoelectronic spectra were recorded. Titanium dioxide was also produced and analyzed. The results indicated that the oxidized surface had a higher energy bond and the oxynitride surface film had an average thickness of about 10 Å. High temperature annealing was ineffective in eliminating that film. Figures 2; references 10: 4 Russian, 6 Western.
[43-12131]

USSR UDC 621.762

REINFORCEMENT OF NICKEL WITH CARBIDE-COATED CARBON FIBERS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 43-46 manuscript received 20 Dec 78

OVCHARENKO, V. YE., KASHIN, O. A., DUDAREV, YE. F., LAPSKER, I. A. and TUROVETS, L. A., Siberian Physico-Technical Institute

[Abstract] Plaits of 300 filaments of the VMN-4 type were coated with carbide in a bath at 1150°C at 10^{-4} mm Hg. Then X-ray structural and spectral analysis was used to evaluate the coating and determine its suitability for strengthening a nickel matrix. Results showed the formation of micropores at the plait boundaries which increased in number and size with increases in the annealing period and its temperature. Successful application of the method reqires preliminary prevention of the carbide's tendency to dissolve in the nickel matrix. Figures 4; references 11: 10 Russian, 1 English.
[43-12131]

USSR UDC 669.018.25:620.187.5

THE INTERRELATION OF STRUCTURE AND PROPERTIES OF HARD ALLOYS WITH TITANIUM CARBIDE BASES

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 73-79 manuscript received 15 Jan 79

PILYANKEVICH, A. N., SHAPOVAL, T. A., DZODZIYEV, G. T. and PADERNO, V. N., Institute of Problems of Material Science, Academy of Sciences Ukrainian SSR

[Abstract] An electron microscope was used in a two-stage replication method. Samples were first shaded with chrome for studying fractures, then with platinum for studying the microstructure. Samples were polished prior to microscopic examination. Samples with low durability during bending, such as the TN-20 alloy, had extremely unequal granular structures and underwent a directional orientation of large and small grains. More durable solid solutions contained titanium carbide grains of less than 2 mkm average width with serrated or angular forms. The prime tasks in improving quality relate to perfecting the technology for preparing the initial compounds, improving sintering processes, and increasing material purity. Temperature factors had varying roles in failure of titanium carbide-nickel-molybdenum products. Figures 5; tables 1; references 9: 6 Russian, 3 English.

[43-12131]

USSR UDC 621.762

MODERN METHODS OF PRODUCING METAL POWDERS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 9, Sep 79 pp 1-10 manuscript received 5 Apr 79

NICHIPORENKO, O. S., Institute of Problems of Material Science, Academy of Sciences UKrSSR

[Abstract] A ten-year survey of the Soviet Union's powder metallurgy industry is made. Some of the highlights of this decade include the first industrial production of iron powders in 1978 by spraying at the Brovarsk Powder Metallurgy Plant (BPMP) where they started up a shop for this purpose with a capacity of 17,000 ton/year. The basis of this technology is spraying synthetic cast iron with compressed air with subsequent annealing of the raw powder in converter gas. This method was developed jointly by BPMP, the Institute of Problems of Materials Science (IPMS) and the Central Scientific Research Institute of Ferrous Metallurgy (TsNIIChermet). The technology of producing iron powders by spraying with

water was developed by Tulachermet, IPMS and TsNIIChermet while the technology of producing iron and their alloys with controlled particle shape was done at IPMS. Reduction of metal oxides is done at various plants by different methods. At the BPMP a horizontal-through furnace is used; at the Sulin Metallurgical Plant (SMP) tunnel furnaces are employed; the Dneprov Aluminum Plant (DAP) uses stack furnaces. The Donets Scientific Research Institute of Ferrous Metallurgy (DonNIIChermet) has developed a flocculation method where ground iron powders are fed into a pulsing magnetic field where they are magnetically oriented, which stimulates formation of the so-called "floccules" that are porous but strong conglomerates when treated further with hydrogen. The development of nuclear power engineering has presented the possibility of forming a nuclear-metallurgical complex for producing pure and cheap hydrogen from the heat of nuclear reactors with subsequent reduction of high purity superconcentrates by the hydrogen. TsNIIChermet and Tulachermet have developed and mastered the metallothermal reduction of iron and alloy steel powders of calcium hydride. Scientists at IPMS have developed and introduced diffusion saturation from point sources in the production of alloyed steels and alloys. The number of new methods of producing powders include combination methods with a scheme of production of raw material-powder-part (spraying with subsequent stamping or rolling of the hot powder, self-propagating high-temperature synthesis (SHS) and methods of rotating electrode spraying and vibrating electrode spraying. The Institute of Physical Chemistry has developed a method of producing inorganic powders based on conducting an exothermal reaction of the components in the SHS mode. References 23: 17 Russian, 6 Western.
[24-6368]

USSR UDC 621.762

MODERN MATERIALS BASED ON REFRACTORY COMPOUNDS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 9, Sep 79 pp 11-24 manuscript received 1 Feb 79

KOSOLAPOVA, T. YA., Institute of Problems of Material Science, Academy of Sciences UKrSSR

[Abstract] The methods employed to produce refractory compound powders are discussed. Plasmochemical synthesis of refractory powders which can be done at 5000-10000°K, was used to synthesize aluminum nitride and can be applied to the synthesis of other refractory compounds. The Institute of Problems of Material Science and the Institute of Metallurgy jointly investigated the production of single crystals of Ti, Zr and Nb carbides by melting sintered cores from the corresponding carbides. At the Physicotechnical Institute imeni A. F. Ioffe production of refractory compound single crystals was studied, where the initial materials are crystallized from solutions into metallic melts. Figures 6; references 29: 28 Russian, 1 Western.
[24-6368]

USSR UDC 621.762

INTERACTION OF YTTRIUM OXIDE WITH CHROMIUM IN THE THIN-FILM STATE IN THE PRESENCE OF OXYGEN

Kiev POROSHKOVAYA METALLURGIYA in Russian No 9, Sep 79 pp 96-100 manuscript received 1 Jun 78

KARPINOS, D. M., LISTOVNICHAYA, S. P., BALAKHNINA, V. N. and OKUNEVSKIY, YU. N., Institute of Problems of Material Science, Academy of Sciences UKrSSR

[Abstract] Luminous and electron microscopy and x-ray phase analysis were used to study the interaction between yttrium oxide and chromium thin films. A three-layer sandwich (yttrium oxide-chromium-yttrium oxide) was applied to a polished policor plate with the thickness of each being about 0.3 microns. When the plate was annealed the sandwich was exfoliated cleanly but, if the film thickness was increased from 0.3 to 1.5 microns, it cracked. Isothermal annealing at 600-1500°C showed that at 900-1000°C the grains in the yttrium oxide film increased to one micron and at 1000-1500°C--up to 3--4 microns. Also a new phase formed which was situated along the yttrium oxide grain boundaries. At temperatures above 1000°C a network of microcracks with a mosaic structure formed on the film surface in all cases. It was concluded that the interaction of the thin-film yttrium oxide-chromium system starts at around 1100°C and is fully complete at 1400°C with the formation of yttrium chromite. The interaction occurs primarily along the microcrack network with a gradual filling of individual cells with the new phase. Apparently, the microcrack lattice plays the role of primary diffusion paths along which the oxygen, necessary for forming yttrium chromite, is transmitted to the yttrium oxide-chromium interphase boundary. Figures 3; references 5: 1 Russian, 4 Western.
[24-6368]

USSR UDC 621.762:621.763:541.13:624/628

DEVELOPMENT OF WORKS IN THE FIELD OF HIGHLY POROUS MATERIALS MADE OF METALLIC POWDERS AND FIBERS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 9, Sep 79 pp 25-35 manuscript received 2 Apr 79

FEDORCHENKO, I. M., Institute of Problems of Material Science, Academy of Sciences UKrSSR

[Abstract] A survey is made of studies devoted to the development of metallic highly porous materials. The existing methods of powder metallurgy employed in producing porous parts such as filters are discussed as well as porous materials made from metallic fibers. Porous materials for electrochemical and electrophysical application and structural penomaterials are briefly discussed and the article concludes with descriptions of the areas of porous material application such as the use of stainless steel filters in nuclear and cryogenic engineering, pharmocology, chemistry, in the production of polymers and synthetic fibers and in separators of liquid and gas media. References 44: 22 Russian, 22 Western.
[24-6368]

REFRACTORY COMPOUND SYNTHESIS DISCUSSED

Moscow IZVESTIYA in Russian 4 Nov 79 p 1

[Article by V. Popovkin: "The Effect of a Fire Wave"]

[Text] This white-hot fire wave, ignited by the hand of man and burning on its own, hidden internal energy, is truly capable of creating miracles. Seemingly unjoinable refractory materials are joined into a solid piece in its flame.

The method, which permits this to be accomplished, has been named the SVS [Self-propagating high-temperature synthesis] method, synthesis of refractory compounds, by scientists of the Institute of Chemical Physics of the USSR Academy of Sciences. Approximately 200 of the most diverse compounds--carbides, borides, silicides, intermetallides and nitrides--have already been produced by using it. Each of them finds practical application in the national economy. An important property unites all these materials: produced by means of so-called "gasless combustion," they have high purity.

"To excite or 'ignite' this self-propagating materials synthesis wave," says Professor, Doctor of Physicomathematical Sciences A. Merzhanov (head of the Department of Macroscopic Kinetics of Chemical Reactions), "a short thermal pulse with temperature on the order of 1,000-1,500 degrees Celsius is sufficient. Synthesis is then developed spontaneously, being propagated in the form of a wave along the entire volume of the material with release of an enormous amount of heat. In this case the temperature rises to 2,000-4,000 degrees."

High-temperature furnaces and high pressure of an inert medium are not needed here and large expenditures of electric power are not required--the synthesis reaction supplies energy by itself. Production of both the synthesized materials themselves and of metallurgical molds of them is practically without waste.

The saving from this work, achieved during the past two years by scientists of the Institute of Chemical Physics in cooperation with producers of the Poltava Synthetic Diamond and Diamond Tool Plant and colleagues from the Institute of Problems of Materials Science of the Ukrainian SSR Academy of Sciences, is 39 million rubles. Investigators are transferring this work, which underwent extensive experimental-industrial debugging, for total industrial introduction at the VPO [All-Union Production Association Soyuzabraziv of Minstankoprom [Ministry of the Machine Tool and Tool Building Industry]].
[54-6521]

6521
CSO: 1842

CARBONITRIDE STRENGTHENING OF STEEL

Moscow STROITEL'NAYA GAZETA in Russian 11 Nov 79 p 3

[Text of interview with USSR State Prize winners V. Kuznetsov and L. Gladshteyn, both of the Central Scientific Research Institute for the Design of Steel Structures, by Correspondent A. Gorbatov: "Testing for Strength"]

> [Text] A team of scientists, engineers, and designers was awarded the title of 1979 USSR State Prize Winners for the development and introduction of highly effective carbonitride-hardened steels. Our correspondent A. Gorbatov asked the prize winners--Chief Engineer of the Central Scientific Research Institute for the Design of Steel Structures V. Kuznetsov, and department head at that Institute L. Gladshteyn--to comment on the significance of this development.

"Inventors sometimes find it difficult to assess the role of their brainchild, but this is a special case. The point is that the development and introduction of a new steel is such a far-reaching project requiring extensive effort by specialists from various branches of the economy that we can state with absolute confidence that our large team of inventors has accomplished a major feat.

"The specialists at our Institute had chiefly to solve the problems of the practical application of the new steel type in construction. As for the development itself of that steel, it was handled by numerous crews of metallurgists, and primarily by the scientists and engineers of the Urals.

"Metal is now a customary basic building material. There is no limit to the use of steel in construction--vehicular and railroad bridges, frameworks of large industrial buildings, huge reservoirs, and even bread bins. The demand for steel is always rising. But the resources of metals are not limitless. And in our opinion the demand for metal can be solved down in one way--by enhancing its strength.

"Attempts to enhance the strength of structural steel have long been in the making. Its carbon content was increased, and it was treated with special additives. That is, alloyed.

"But until recently structural steels with a yield point of more than 50 kg per square millimeter did not exist. The problem was that welding is widely employed to join metal structures. And increasing the content of carbon and alloy elements in steel is detrimental to its weldability.

"Still this problem was finally solved in our country by developing economically effective high-strength and cold-resistant steels for structural weldments in mass use. A fundamentally new method for modifying the structure and properties of metal, termed the carbonitride hardening method, has been developed.

"This hardening method is based on using vanadium as the principal alloy element. It is added in the amount of from 5 to 15 hundredths of a percent to steel. It has now become possible to widely apply carbonitride hardening in order to obtain the most broadly used steels, since vanadium output in our country has in recent years been increasing.

"The industrial production of rolled stock from the new structural steels has been organized at the Orsk-Khalilovka and Nizhnetagil' metallurgical combines and at the Novolipetsk and Cherepovets metallurgical plants. These high-strength steels are used to fabricate effective welded components of the frames of large industrial buildings, bridges, trestle structures, reservoirs, gasholders, blast furnaces, and large load capacity cranes.

"But that is not all.

"As soon by numerous studies, the method is universal and can be used to enhance the quality of steels of varying purpose.

"On the basis of the principles of carbonitride hardening a unified group of low-alloy structural steels with coordinated strength levels has been developed for the first time in Soviet practice. This has provided designers and planners with a selection of effective materials for use not only under standard climatic conditions but also at temperatures below -40°C."
[47-1386]

1386
CSO: 1842

USSR UDC 66.14.18.258.2

DEVELOPMENT OF 30Kh3NM3FTs HIGH STRENGTH HEAT RESISTANT STEEL

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 10, 1979 pp 51-55

ZAKHAROV, V. N., PERTSOVSKAYA, YE. V., SKLYUYEV, P. V. and ZONOV, V. V., Uralmash Production Association

[Abstract] The new low-tungsten 30Kh3NM3FTs steel (% content: 0.28 C, 0.32 Si, 0.23 Mn, 2.5 Cr, 1.35 N, 2.5 Mo, 0.40 V, 0.012 S, 0.012 P, 0.06 Zr) was developed as a substitute for the scarce 3Kh2V8F tunsten steel. It is superior to other previously tried substitutes, because it is additionally treated with 1.0-1.5% Ni and 0.04-0.1% Zr. Treatment with Ni makes this steel amenable to air quenching, while the addition of Zr enhances the stability of supercooled austenite, with Zr acting as a modifying agent assuring a spheroidal shape of sulfides as well as of the phases segregating along the grain boundaries, and thus resulting in an increase in the plasticity and impact strength of the metal, which is equivalent to reducing the sulfur content of the steel from 0.025% to 0.010%. This new steel can be used in lieu of 3Kh2V8F steel as the material of pressforging components measuring up to 200 mm in cross section and performing under static loading. The short-time strength of 30Kh3NM3FTs steel at normal and high temperatures as well as its hot hardness and stress-rupture strength and other properties are close to those of 3Kh2V8F steel, while its plasticity and impact strength are even higher. Figures 5; references 5: 4 Russian, 1 Western.
[23-1386]

USSR UDC 621.78.061

EFFECT OF OXIDATION IN VARIOUS MEDIA ON IN VACUO GAS RELEASE BY 12Kh18N10T STEEL

Moscow IVUZ. MASHINOSTROYENIYE in Russian No 10, 1979 pp 110-114 manuscript received 16 Feb 78

MAKAROVA, V. I., SAFONOV, A. N., SKIBINA, G. V. and YEROKHINA, V. I.

[Abstract] At present 12Kh18N10T corrosion-resistant austenitic class steel is used as the principal structural material in vacuum systems. But the conventional techniques of reducing its gas release rate in vacuo are excessively complicated. In this connection, it is shown that heating that steel at 600°C for 2-3 hr in an atmosphere with a low partial pressure of oxygen (in vacuo or alternately in vacuo and in hydrogen) reduces

to a minimum the formation of the oxide Fe_2O_3 and promotes the formation of surface oxide films (spinel FeO x (Fe, Cr)$_2O_3$) and rhombohedral (Fe, Cr)$_2O_3$) which, owing to their high chromium content, provide a barrier to the release of the hydrogen and carbon dissolved in the bulk of the metal. Such treatment reduces to one-sixteenth the overall gas release rate of the steel compared with its passivated counterpart. The high performance characteristics of the resulting steel surface (low gas release following prolonged exposure to the atmosphere as well as subsequent cleaning of the surface) serve to simplify the production technology of vacuum systems. Figures 3; references 3 (Russian).
[18-1386]

USSR UDC 621.186.4:669.15'24'25'28'27'295-192

ON THE MECHANISM OF SLOW FAILURE OF TYPE N17K10V10MT HIGH-STRENGTH MARTENSITE-AGED STEEL

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No 9, 1979 pp 38-41

KARDONSKIY, V. M., MALKIN, V. I., GORBUNOVA, N. B., Central Scientific Research Institute of Ferrous Metallurgy imeni I. P. Bardin

[Abstract] Samples of N17K10V10MT steel were aged at different temperatures and deformed at a rate $\varepsilon = 10^{-3}$ and 10^{-5} sec $^{-1}$. A plot of the parameters of relative thinning and limits of strength show that after aging at 400-500°C, the plasticity of the steel at small deformation rates is sharply reduced. Minimal necking is observed after aging at 420 - 450°C. Photomicrographs show that a fracture in steel aged at 420°C has a pitting pattern similar to unaged steel. As the aging temperature is increased, both the plasticity and the strength of the steel increase. In order to observe the embrittlement of the steel, it must be subjected to loading for longer periods of time. Hydrogen embrittlement is particularly noticeable in samples aged at temperatures of 420 - 450°C and is accompanied by the breakdown of the solid solution. The reaction of the hydrogen with dislocations in the material structure does not significantly influence the embrittlement process. The temperature after which embrittlement occurs increases with increasing duration of aging. Figures 3; references 2: 1 Russian, 1 Western.
[26-12027]

USSR UDC 621.762

THE EFFECT OF STRUCTURAL FACTORS ON MECHANICAL PROPERTIES OF SUPERHARD MATERIALS BASED ON BORON NITRIDE

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, 1979 pp 61-69 manuscript received 6 Apr 79

BOCHKO, A. V., GRIGOR'YEV, O. N., DZHAMAROV, S. S., KARYUK, G. G., KURDYUMOV, A. V., OLEYNIK, G. S., PILYANKEVICH, A. N., TREFILOV, V. I., FRANTSEVICH, I. N. and SHATOKHIN, A. M., Institute of Problems of Material Sciences Ukrainian SSR

[Abstract] Analyses by optical and electronic microscopy, X-rays, micropressure tests, radial fracture length, and load hardness were made on hexanite-R, "elbor," PTNB-3MKT, PTNB-IK-1, "belbor," "ismit-2" and "ismit-3," and a composite. All of these Soviet products were tested using production samples except hexanite-R. Analysis showed that for the smaller grain textured compounds hexanite-R, ismit-1 and ismit-3, intercrystalline failure was typical, while with increasing granular dimensions trans-crystalline failure grew. In polydispersion materials mixed forms were found. The effects of sphalerite, wurzite and graphite-type phases were not related to hardness. Two-phase hexanite-R had the greatest dispersion, homogeneity of grains, and consistency. The other materials were more subject to brittle fracture, low dispersion, and the presence of impurities and irregular phase content. Figures 5; tables 3; references 17: 12 Russian, 4 English, 1 German.
[43-12131]

USSR UDC 669.295.'71'292'28:539.4.015

A STUDY OF THE STRENGTHENING OF HIGH TEMPERED TITANIUM ALLOYS IN THERMOMECHANICAL TREATMENT

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 48 No 1, Jul 79 pp 141-147 manuscript received 22 May 78

ANISIMOVA, L. I., MAKHNEV, YE. S. AND POPOV, A. A., Ural Polytechnical Institute imeni S. M. Kirov

[Abstract] Industrial VT22 high-tempered titanium alloy, containing 5.5% Al, 4.5% V, 4.5% Mo, 1.3% Cr and 1.1% Fe, was tested at temperatures ranging from 820 to 1000°C with subsequent water cooling, and with varying degrees of deformation, ranging from 0 to 50%. Specific effects of the two parameters on the alloy are discussed. Results indicated that granular creep occurs in the temperature range up to 40% compression, thus preventing strengthening of the alloy. Aging tests in the range of 625-650°C with deformation in the alpha-beta zone brought intensive coagulation of alpha-phase particles. The optimum results in mechanical properties came with deformation in the two-phase zone and subsequent aging at 630-640°C for 2-4 hours. Figures 4; references 3 (Russian).
[31-12131]

USSR UDC 541.44:539.238

SOME FEATURES OF THE SYNTHESIS OF THIN FILMS OF TRANSITION METAL HYDRIDES

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 15 No 9, Sep 79
pp 1579-1584 manuscript received 5 Jul 78

KHODYREV, YU. P., BARANOVA, R. V., IMAMOV, R. M. and SEMILETOV, S. A.,
Institute of Crystallography imeni A. V. Shubnikov, Academy of Sciences
USSR

[Abstract] The methods of producing thin films of transition metal hydrides for electronographic structural analysis and phase-formation relationships were examined. Experiments were conducted to synthesize hydride thin films by interaction of metallic films (Pd, Ni, Au, Cr, Sc) with molecular and atomic hydrogen and with H+ ions, by cathodic spraying in an H_2 atmosphere (Ni, Pd, Sc, Co, Cr, Cu and Ag), by electrochemical deposition (for Cr hydrides), electrochemical saturation (Ni and Pd) and by combustion of metals (Ni, Pd, Co, Ti, V, Ag and Au) in hydrogen. From structural and interstitial phase analysis the lattic type and parameters were identified for the metals used to form the hydride. Since nitrogen impurities were present in the hydrogen and residual gases of the electronograph, ammonia was formed which in turn created nitrides in the hydride films. References 23: 10 Russian, 13 Western.
[49-6368]

USSR UDC 546.821+546.18

INVESTIGATION OF THE KINETICS AND MECHANISM OF INTERACTION OF TITANIUM WITH PHOSPHORUS VAPORS AT 800°C

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 15 No 10, Oct 79
pp 1868-1869 manuscript received 11 Apr 78

UGAY, YA. A., ILLARIONOV, A. A. and GUKOV, O. YA., Voronezh State University

[Abstract] When rectangular plates of VT-1-0 grade titanium are annealed at 800°C in the presence of phosphorus vapors the weight of the samples is increased by the formation of Ti phosphides. When the process is conducted at pressures below 2.5 atm the growth of the phosphide layer consists only of TiP and its growth follows the quadratic law. At pressures of 5-10 atm growth of the phosphide layer changes to logarithmic and consists of the TiP layer and a thinner TiP_2 layer. These films provide excellent protection of the titanium from corrosion by hydrochloric and sulfuric acids. The phosphide films provide corrosion protection by retarding diffusion of those elements which can react with titanium to produce corrosion. Figures 2; references 5: 4 Russian, 1 Western.
[48-6368]

USSR UDC 669-176:669.295

THE INFLUENCE OF TEXTURE ON THE MEMORY EFFECT OF TITANIUM NICKELIDE FORMS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No 9, 1979 pp 62-63

MONASEVICH, L. A., PASKAL', YU. N., PRIB, V. E., TIMONIN, G. D., and CHERNOV, D. B.

[Abstract] A study of the memory effect of titanium nickelide was made using a 50 atomic wt % Ni alloy of Ti. The texture, determined by using a difractometer, could be described on the basis of the ideal orientation (112) [110]. The greatest deformation accumulated in samples intersected at angles of 0,22.5, and 45° to the "direction of rolling" during the preparation of the samples. Somewhat less deformation accumulated in those samples intersected at an angle of 90° to the "direction of rolling" and significantly less in those samples intersected at 67.5°. This relationship held when the rotation stress was increased to 30 kg/mm^2; however, the differences among the various angles decreased with increasing loading. A relationship was also observed between the temperature of initiation of the martensite transformation under loading M_1,

and the orientation of the axis of the sample relative to the "direction of rolling", (30 - 50°). The greater the accumulated deformation, the higher the M_i. The temperatures of initiation (A) and completion (B) of the reverse martensite transformation under loading vary within the range of 10 - 15°C: the greater the accumulated deformation, the lower are A and B. Figures 2; references 6: 2 Russian, 4 Western.
[26-12027]

USSR UDC 669.295

AN INVESTIGATION OF THE POSSIBILITY OF PHOTOMETRIC SORTING OF SPONGE TITANIUM ON THE "SORTEKS-621" SEPARATOR

Ordzhonikidze IVUZ. TSVETNAYA METALLURGIYA in Russian No 5, 1979 pp 88-91
manuscript received 30 May 78

TSYPIN, YE. F., LIKHTERMAN, V. A., SHIRYAYEV, R. YE. and CHERNITSKIY, L. P., Leningrad Mining Institute, Department of the Metallurgy of Light and Rare Metals

[Abstract] Sorting of sponge titanium for specific defects by adjusting the separator for the individual defect, general defect sorting with a single setting, and two-phase sorting using the "Sorteks-621" were investigated. It was found that defective pieces of all types could be rejected except those with residual powder metallurgy flaws. The best results were obtained when the separator was adjusted for a particular flaw. The greatest success was in eliminating defects related to oxidation and burning. Improved surfaces, light filters, and sensitivity adjustments would bring better results. References 2 (Russian).
[41-12131]

USSR UDC 669.017

THE EFFECT OF INITIAL STRUCTURE ON DEFORMATION RESISTANCE AND THE QUALITY OF STAMPINGS OF VT9 ALLOY DURING ISOTHERMIC DEFORMATION

Ordzhonikidze IVUZ. TSVETNAYA METALLURGIYA in Russian No 5, 1979 pp 71-74 manuscript received 10 Jul 78

BRAILOVSKAYA, B. F., YELAGINA, L. A., PILIPENKO, A. L., KAS'YANOV, S. A., and FREYMAN, L. B., All-Union Institute of Light Alloys

[Abstract] The effect of initial structure was evaluated under isothermic precipitation conditions and then tested under actual isothermic stamping conditions, using a fine globular and fibrous structure and a coarse granular structure of the alloy, at varying rates of deformation and at a temperature of 950°C in the alpha and beta phase areas. In the fine structure, granules increased in size during the process from 3 to 6 mkm, while maintaining axial form and increasing the degree of recrystallization. Little change occurred in the coarse structure at 30% deformation. Easier stamping and better stability after stamping was found in the fine-structured version of the alloy. The process surpassed the norms required for production. Figures 2; references 2 (Russian).
[41-12131]

USSR UDC 669.295:293:539.63

PHASE TRANSFORMATION IN TITANIUM-NIOBIUM ALLOYS UNDER THE EFFECTS OF SHOCK WAVES

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 48 No 1, Jul 79 pp 211-213 manuscript received 1 Aug 78

SIKOROV, V. N. and DEGTYAREVA, V. F.

[Abstract] Alloys containing 10, 20 and 30% Nb were annealed at 500°C for 5 hours in a vacuum of approximately 5 10^{-5} mm Hg, then subjected to shock waves from an explosion. Results indicated than an omega phase formed only when alpha-phase content was present in the original alloy. Thermal stability and phase content under pressure for the omega phase were measured. Omega-phase content was shown to decrease with increased temperature, and to be less after shock loading than under a static load. References 10: 7 Russian, 3 Western.
[31-12131]

BRIEFS

VACUUM WELDING--Simple contact of an aluminum wire to a single crystal of germanium forms a weld so strong within a fraction of a second that a break occurs in a different place during subsequent tests. These experiments are being carried out at one of the laboratories of the Institute of Physics of the Latvian SSR Academy of Sciences under superhigh vacuum conditions close to space conditions in their degree of evacuation. Ideal purity of materials in the contact zone is maintained here, as a result of which the atoms enter into direct interaction and are coupled to each other. Scientists feel that the first results of the "contact welding" method are of practical interest to modern electronics. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 7 Aug 79 p 1] 6521
[54]

USSR UDC 621.791.016:669.295

DIFFUSION WELDING OF INDUSTRIAL TITANIUM ALLOYS

Kiev AVTOMATICHESKAYA SVARKA in Russian No 9, 1979 pp 47-51 manuscript originally received 13 Mar 78, in final form 25 Jul 78

NAZIMOV, O. P. and GORSHKOV, YU. V., Candidates of Technical Sciences, and BELYKH, N. G. and IL'IN, A. A., Engineers, Moscow

[Abstract] OT4, OT4-1, VT20, VT6, VT16 and VT15 industrial alloys were welded in various combinations directly and with intermediate layers. Welding was done in a laboratory vacuum furnace, after preliminary cleaning with acetone and alcohol, and at varying pressures. Results showed that satisfactory seams were obtained with the use of alloys with similar atomic weights with stable configuration or alloys with atomic weights with stable configuration that promote electronic adhesion. Where an intermediate layer was used, satisfactory bonds were obtained but the nature of the seams differed markedly from the alloys joined. Figures 4; references 9 (Russian).
[32-12131]

METALLURGICAL PRODUCTION DOWN IN VARIOUS SOVIET PLANTS

Moscow PRAVDA in Russian 13 Nov 79 p 2

[Unsigned article: "In Spite of Tradition"]

[Text] The country's metallurgists failed to meet production goals set for the first nine months of this year. Even less steel and rolled iron were produced during this period than in the first nine months of last year.

In a number of cases the shortfall has now reached alarming proportions. Production at the Kuznets Metallurgical Combine decreased by almost ten percent compared to the same period last year. The Nizhne-Tagil and Karaganda Combines, the Zapsib [West-Siberian Metallurgical Plant imeni 50th Anniversary of October] and enterprises of the Ukrainian SSR Ministry of Ferrous Metallurgy, as well as the Cherepovets, Novosibirsk, Gor'kiy and Chelyabinsk Metallurgical Plants all operated below capacity.

Tasked by the editorial office, "PRAVDA" correspondents visited some metallurgical plants and spoke with their managers, specialists and laborers. What are the reasons for the lapses that have been allowed? What measures are being taken to correct the situation that has developed? What reserves are being activated? How are socialist competition and advanced methods being used to these ends?

V. Gorbachev, chief of the Industrial-Transportation Section of the Dneprodzerzhinsk City Party Committee, has had a stack of telegrams on his desk since early morning. Each one of them appeals to him to send something, assist someone or exert his influence on someone. Who is the subject of all these appeals? The management of the Metallurgical Plant imeni Dzerzhinskiy.

"Over a period of ten months we have been in arrears in our obligation to a number of customers for a large quantity of rolled iron," plant director G. Gurskiy told V. Cherkasov, "PRAVDA" correspondent for the Dnepropetrovskaya Oblast. "And this debt is, alas, still growing. Over the last 27 years 401 million rubles have been invested in development of primary production while a total of 2.9 million was spent on maintenance services. This is 0.72 percent of the total allocation while the standard is six percent. And so frequent breakdowns, accidents and low-quality products have resulted."

On the initiative of the Baglayskiy by-product coke plant an open competition began three years ago among cooperating plants -- all those involved in turning out the final product -- rolled iron. A marked improvement was made in fulfillment of customer orders and day-to-day mutual assistance between the collectives grew stronger. But party and trade union committees did not concern themselves with development of this competition and it gradually ground to a halt.

"PRAVDA" associate correspondent I. Sergeyeva reports from Zaporozh'ye that the "Dneprostal'" plant is in arrears to the country for almost three million rubles worth of products. This is an unexpected showing for a collective that brilliantly fulfilled the past two five-year plans. One of the reasons for the shortfall here is poor organization of maintenance work. Outages of the electric furnace have become more frequent.

By the way, no lack of maintenance organizations is perceived. But their collectives show little interest in final results -- the stable operation of the metallurgical enterprises. But then the maintenance units in the non-ferrous metallurgical plants here in Zaporozh'ye do answer for their work. A competition for guarantee certificates of quality has been organized.

"Zaprozhstal'" is in arrears for 74,000 tons of steel and 49,000 tons of rolled iron. Of the problems the collective has encountered in recent years, those most frequently cited are difficulties with supply of coke, scrap metal and ore-concentrate ingots and shortages of personnel. Labor turnover has reached 20 percent and the plant is short hundreds of laborers. On-the-job training is poorly developed here and young people are slow to master essential professional skills.

In due course a competition was developed in Donbass metallurgical enterprises under the slogan "Interests of Cooperating Enterprises Above All!" Its essence was that collectives bound together by a single technological chain should help each other and strive to satisfy each other's needs.

The effectiveness of this competition has now markedly declined. "PRAVDA" correspondent for the Donetskaya and Voroshilovgradskaya Oblasts, I. Tikhomirov, reports that because of the low quality of ore-concentrate ingots arriving from the Central Ore-enrichment Combine blast furnace operators at the Kommunarsk Plant are in arrears for tens of thousands of tons of cast iron. Work results of the steel smelters and rolling mill operators are no less disquieting. The Yenakiyevo and Makeyevka Metallurgical Plants are in arrears for huge amounts. And the main reason here is a lack of intercommunication and elementary mutual understanding between the cooperating collectives. At Yenakiyevo, the example, the oxygen converter shop constantly lets the rolling mill operators down. Labor and technological discipline in this shop is low.

V. Shalgunov, "PRAVDA" correspondent for the Orenburgskaya Oblast, reports that according to a statistical account published by the local press the Orsk-Khalilovo Metallurgical Combine met its goals by 100.4 percent. But the enterprise is receiving alarming letters and telegrams from customers and is paying them large fines for non-delivery of products. What is the matter here? The fact of the matter is that the enterprise meets its quotas but at an uneven pace, falling thousands of tons behind in its obligations to provide steel to customers. Responsibility for this rests, to a significant degree, with the cooperating enterprises. Orsk-Khalilovo blast furnace operators have failed to receive hundreds of thousands of ore-concentrate ingots from the Lebedinskiy Combine since the first of the year. The Bekabad Metallurgical Combine in the Uzbek SSR has failed to deliver thousands of tons of ingots for the "800" rolling mill.

The enterprise itself is not without its own internal deficiencies. The leaders of the enterprise are slow to develop its transportation. Due to the fault of maintenance workers, who have dragged out their work for an intolerable length of time, blast furnace number one operated below its capacity for two years.

At the "Krasnyy Oktyabr'" Metallurgical Plant in Volgograd "PRAVDA" correspondent V. Goncharov was told that the main reason for this plant's shortfall is disproportion in development of the enterprise. Steel smelting production last year was 78,000 tons greater than in 1975. But rolling mill production, to all intents and purposes, showed no growth during this period. The rolling mills in operation do not provide the required productivity and they frequently break down. And here is the result: the plant has fallen in arrears for 39,000 tons of rolled iron since the first of the year. Shortfalls have also been allowed in production of steel. The USSR Minchermet [Ministry of Ferrous Metallurgy] is not assisting the enterprise in solving its problems of technical re-equipment. The Volgograd workers are also being let down by their suppliers. Specifically, the Karaganda Metallurgical Combine is in arrears for cast iron and the Chelyabinsk Combine owes them steel ingots.

The Rustavi Metallurgical Plant emerged from competition in first place and won the challenge banner of the USSR Minchermet and the trade union central committee for 17 quarters in a row. Now it has failed to meet its quarterly goals. Kirovo failed to deliver 30,000 tons of ore-concentrate ingots and Voroshilovgrad failed to deliver coal concentrate.

As plant director O. Suladze told our Georgian SSR correspondent, G. Lebanidze, the collective is filled with determination to overcome its shortfall by the end of the year and fulfill its plan and obligations. However the collective is worried about the future of the enterprise. The sintering plant is morally and physically obsolete and beyond reconstruction. But, due to unsatisfactory financing and material-technical supply, the timetable for completing construction on a new one has been broken more than once. Re-equipment of the blast furnace, open hearth and rolling plants has also been dragged out. And if these problems are not resolved future breaks in rhythm will be unavoidable....

> These six reports from our correspondents paint a rather spotty picture of the problems and difficulties encountered by ferrous metallurgy workers. But still they have much in common.
>
> This branch of industry has evidently lessened its attention to development of socialist competition, first of all, among cooperating collectives. "With uncommon ease" they default on reciprocal obligations and fail each other as well as their customers. Rich traditions, nurtured within this industry for many years, have been to a significant degree lost. The "rear area" of many plants has fallen behind. Labor and technological discipline as well as responsibility of personnel in various branches leave room for improvement. Many important provisions of the resolution, adopted by the CPSU Central Committee and the USSR Council of Ministers in 1977, "On Measures for Further Development of Non-Ferrous Metallurgy in Accordance with Decisions of the 25th CPSU Congress," have not yet been implemented.

One would like to hope that this shortfall in ferrous metallurgy is a temporary phenomenon and that this leading branch of industry will arrive at the end of the year and this five-year plan with high indicators, satisfying the needs of our national economy.

[35-12184]

12184
CSO: 1842

METAL RESERVES IN THE OCEAN DISCUSSED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 Nov 79 p 2

[Article by Professor B. Yegiazarov (Leningrad), Chief Geologist of Sevmorgeo Scientific Production Association, Doctor of Geological-Mineralogical Science: "Toward Marine Metal Reserves"]

[Text] Some scientists think that the earth's reserves of many metals will be depleted earlier than its fuel and energy reserves. This means that it is already time to be concerned with the future. It is fortunate that mankind has such a potential source of metals as the bottom of our seas and oceans. First of all the shelf -- the shallow part of the ocean that lies along the coastline.

Every year rivers bring hundreds of millions of tons of sand to the ocean. Along with the sand they bring many thousands of tons of metals. Ancient and modern-day deposits of titanium, zirconium, iron, tin and gold were formed in this way. It is more profitable to develop these deposits than to mine ores on land. Here there is no need to remove a covering layer of barren rock or destroy tillable and pasture lands. There is no need to create tailings and refuse dumps, which also occupy large areas of valuable land, or to build railroads, highways and access roads.

Prospecting for marine mineral deposits is just beginning. The pace of its idustrial adoption is being held back primarily by insufficiently developed technology. However, in some states, which unlike our country do not have large mineral reserves on land, development of off-shore deposits has been under way for a number of years. The most intensive efforts to prospect for cassiterite (tinstone) are being made in Indonesia. Ocean dredges extract more than 6,000 tons of concentrate here each year. Numerous mineral beds -- of magnetite, ilmenium, rutile, zirconium and monazite -- are being developed in Japan and Australia. Some countries are exploiting deposits of building minerals. Exploration provides evidence that deposits of valuable hard minerals may be discovered in the shallow shelf areas of the USSR.

Exploitation of marine deposits involves a difficult and complex body of work which includes geological survey of the shelf, scientific forecasting, exploration, prospecting and mining of the beds that are found.

The main purpose of a geological survey of the shelf, just as a survey of any area on land, is to create a geological map which serves as a source of objective and comprehensive information. This map serves as a reliable base for scientific forecasting and discovery of mineral deposits. Many large deposits have been discovered and ore-bearing regions and branch points, oil, gas and coal basins have been isolated and mapped during the geological survey process itself. For these reasons, geological survey of the shelf of the USSR should be upgraded to the status of a state geological survey. Forecast appraisal and exploratory prospecting work is now being done on the country's shelfs. The Marine Geological Administration of the RSFSR Ministry of Geology has discovered and is exploring several composite deposits which contain titanium, tin, zirconium and other valuable metal ores. According to preliminary estimates, development of the composite deposits in the maritime regions would be altogether profitable. Valuable metal deposits have discovered in the shelf areas of the north-eastern seas by the Sevmorgeo [Northern Maritime Geological Association] and VNIIMorgeo [All-Union Scientific Research Institute of Maritime Geology and Geophysics].

In essence, the quest for off-shore mineral deposits means the birth of a new field -- marine geological prospecting. Its development requires fundamentally new theoretical, technical and organizational decisions. The primary directions for scientific-technical, design and geological prospecting efforts to evaluate the metal-yielding potential of the shelf areas of the Soviet Union were set forth by the coordinated plan of the USSR State Committee for Science and Technology and the problem plan of the USSR Ministry of Geology for the 1976-1980 period. In accordance with these documents the Sevmorgeo Association, as the head organization in the field of "sea and ocean hard minerals" and in cooperation with organizations of other departments, developed a composite program of scientific-research, experimental-methodological and geological prospecting work. Specialized marine organizations of the USSR Ministry of Geology, RSFSR Ministry of Geology, USSR Ministry of Non-Ferrous Metallurgy, problem laboratories and faculties of many of the country's institutions of higher learning and also laboratories of the institutes of the USSR Academy of Sciences' Far Eastern Scientific Center are all taking part in realization of this program.

The area covered by the shelfs of the USSR totals several million square kilometers. This is not much less that the entire continent of Australia. Much diverse technical equipment is required to conduct operations over such expanses. First of all, of course, it requires specialized geological-geophysical vessels and floating drilling rigs for both arctic and subarctic conditions. Photo-television observations and underwater exploration using manned and automatic submarine equipment could be of great use.

Practice has shown that high results are yielded by composite geophysical explorations: seismic reconnaissance, electronic reconnaissance, gravel survey, radiometric survey and hydromagnetic observation. It is essential that serial equipment be created for these explorations as well as means for affixing radionavigational data, without which the observations lose their value.

On land it is sometimes sufficient for a geologist to bend down, pick up a stone and examine it. But if he wants to examine rock at sea he cannot do it without submarine equipment, samplers and drills.

Unfortunately, in most cases the instruments and equipment for marine geological work exist only in working models. The reasons for this are many and varied.

This work is now under way in various organizations of the country. Separate mock-ups and experimental models of marine equipment are being built, for example, in laboratories of the Moscow and Leningrad Mining Institutes, the VNIIPIGORtsvetmet [All-Union Scientific-Research and Design Institute of Mining Non-Ferrous Metals] of the USSR Ministry of Non-Ferrous Metallurgy, the Institute of Geological Prospecting imeni S. Ordzhonikidze, the Institute of Electrical Engineering for Communication imeni Bonch-Bruyevich, the Pacific Ocean Branch of the Maritime Geological Administration, the VNIIMorgeo, the Sevmorgeo and the Yuzhmorgeologiya [Southern Maritime Geological] Association. But the work is progressing slowly.

It is essential, in my opinion, that a unified service by created in the USSR Ministry of Geology system for creation of low-serial production of technical means which will ensure systematic study and industrial exploitation of the mineral resources of the vast shelf areas of our country. A specialized design bureau with experimental production capabilities must be set up to develop and test models and produce small series of devices and equipment for marine geological prospecting work -- on the shelf and all the world's ocean area.

Considerable funds will be required to provide maritime geological prospecting projects with specialized and drilling vessels, equipment and apparatus. The USSR Ministry of Geology and USSR Gosplan must make provisons for these funds in their plans for the 1981-1985 period. Construction of vessels equipped with the latest navigational and geophysical equipment and drilling rigs should already be included in the plans of the Ministry of Shipbuilding Industry, the Ministry of Instrument Making, Automation and Control Systems Equipment and other departments involved in the previously coordinated program.

It seems rational to combine the efforts of the USSR Ministries of Geology and Non-Ferrous Metallurgy for resolution of technical and technological problems. They have already concluded an agreement on scientific cooperation which provides for development of methods and creation of technical means for exploration, prospecting and industrial exploitation of the hard mineral deposits on our continental shelf. They have established joint bases, test ranges and expeditions. This step may be considered the beginning of a much larger program projected for the long term.

Rapid development of marine geological prospecting will facilitate exploitation of the mineral resources under our seas and oceans and put them into the service of our country's national economy.
[38-12184]

12184
CSO: 1842

NEW METHODS OF CASTING BEING INTRODUCED SLOWLY

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian No 251 1 Nov 79 p 2

[Article by Ukrainian SSR Academy of Sciences Academician V. Yefimov, Director of the Ukrainian SSR Academy of Sciences Institute of Problems of Casting: "Purposeful Search"]

[Text] Every machine is assembled from parts. And parts are frequently machined, improved castings obtained in the one case by a modern, advanced method and in another by an obsolete, inefficient method. This difference in means of attaining the objective constitutes a vast unutilized reserve in the first-stage production aspect of the modern machinery industry. Calculations indicate that adoption of new casting methods proposed by science will make it possible to boost the castings weight accuracy factor to 0.92 and to cut in half machining allowances. Extensive employment of these methods just in the Ukraine will produce savings of a million tons of metal, and 4.5 million tons on a nationwide scale.

Such special methods are well known: pressure casting, chill casting, centrifugal casting, lost-wax casting, continuous casting, and others. Unfortunately, sand mold casting remains the principal method, although it is difficult to obtain in sand molds high-accuracy castings with the requisite surface finish, and this means it is not possible to obtain minimum machining allowances. It is true that science, teaming up with practical work, has been able to improve this method of shaping, proposing, for example, molding sand molds under high pressure. But no matter how much we improve the traditional method, and the scale of their utilization compels us to work in this area, qualitative changes can be expected only from new technological solutions. At those enterprises, for example, which produce such critical parts as diesel engine crankshafts, rolling mill rolls, and high-pressure tanks, one would hardly consider traditional casting. EShL [electroslag casting] is employed for these applications -- a fundamentally new technology which combines the advantages of electroslag melting -- obtaining high-purity metal -- and chill casting. As a result it is possible to produce not only precision, high-strength parts but also to obtain considerable savings.

Experience indicates that whenever it is a matter of major qualitative changes, guaranteed success is brought by the combined efforts of scientists, production specialists and organizations working with problems of technological advances, for only then does a new innovation become widely utilized and produce appreciable economic effect. Take the following examples. Centrifugal casting of pipe, bushings and other items is not a new process. Equally well known is a drawback of this process: under the effect of centrifugal forces all impurities in the metal are forced to the interior surface of the casting, which as a rule is the working surface of the future machine part. Per se it is a good method -- simple, high-productivity, but with this defect. It is necessary to increase the allowance sufficiently so that machining will remove the defective portion of the interior surface. This is not the best solution. Our institute has developed and has already extensively incorporated at Soviet enterprises a totally new centrifugal casting process employing a liquid flux with modifying and refining addition agents. And the situation has changed abruptly. According to results achieved just at the Kiev Plant imeni Lepse, where the new process was adopted for casting cylinder liners for tractor motors, machining allowances have been cut in half.

One technique providing considerable metal savings is the employment of bimetallic and laminated parts in machine structures. This is particularly effective in those cases where special qualities are required in a certain portion of a machine part. It of course would not be an intelligent solution to cast an entire part from a wear-resistant alloy if for practical purposes it suffices to protect only its working surface. At the Ukrainian SSR Academy of Sciences Institute of Problems of Casting we have developed a process for mass production of bimetallic items which previously had problems of wear. This process is very effective, since it not only ensures the manufacture of durable parts but also makes it possible to restore worn parts to service. For example, the road wheels of crawler tractors wear out in 2000 hours. Today they are no longer sent for remelting; a high-strength iron is poured into a casting mold onto the worn rim, and the wheel is as good as new, sometimes better. This rejuvenation process can be repeated again and again.

The Kiev City Committee of the Communist Party of the Ukraine displayed a fine example of the combined approach, taking under the supervision of special volunteer commissions efficient developments in various areas of machine building, including in foundry production. What we are dealing with is a joint quest by scientific teams, production workers, and accelerated implementation of ideas. In practical terms this is organization of the work performed by institutes and enterprises on a joint research and adoption plan within the framework of a comprehensive specific program. Kievlit'ye is one such program. It encompasses problems of improving the organizational structure and improving industrial process service, adoption of advanced casting methods, development of new foundry equipment, sharp decrease in manual labor on heavy operations, development of fully automated, remote-control machine aggregates, etc. The alliance between scientists and production people will result in the development of highly-sophisticated foundry shops in which working conditions will be in conformity with the demands of the time.

Fundamentally new technical solutions change unrecognizably the countenance of traditional production. Sections at the Kommunist and Mayak plants where ladleless pouring of aluminum into molds is employed can be called exemplary. The motorcycle plant has adopted a process for obtaining cast iron with preselected properties for casting crankshafts.

But the combined approach should of course be implemented not only on a regional scale. It should also be of a branch and interbranch character. Unfortunately this is not always observed. For example, induction melting accounts for only 2% of total foundry iron production in this country. Forced to make machine parts of low-grade iron and carbon steels, machinery engineers increase wall thickness at the design stage, and consequently the weight of the castings. Thus the metal requirements of products increase. We know that 60% of the value of a machine is the cost of the materials. A technical problem becomes an economic problem.

Many years ago our institute succeeded in developing a method of obtaining an excellent structural material -- high-strength cast iron with spheroidal graphite. This method is disseminating very slowly, however. In this republic, for example, castings of this high-strength iron are being made at only 11 plants. And yet the area of this application could be very broad. Even the machine building ministries are failing to show a professional interest in the wealth of possibilities of modified materials. Who if not the Ministry of Ferrous Metallurgy should be backing a new process which makes it possible substantially to increase equipment durability? And it is precisely this ministry which is failing to carry out its own orders calling for the earliest possible movement on-stream of a combined modifying agent shop at the Almaznyanskiy Ferroalloy Plant.

Inoculation, that is, treating metal with small quantities of special addition agents which give it new properties, is of great significance for the national economy. Additional ways to achieve savings are opening up. With inoculation of steel, for example, the content of nonmetallic inclusions decreases 3-5-fold. This means a sharp improvement in the stress-strain properties of a material, making it possible to reduce the metal requirements of machinery, to increase operational reliability and to make machines more durable.

In short, a substantial scientific development backlog has been created and is continuing to build up. Earliest possible implementation will ensure a substantial increase in the efficiency of foundry production and consequently of the entire economy.
[34-3024]

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COBALT PRODUCTION REPORTED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 3 Nov 79 p 1

[Article by TASS correspondent R. Trusov: "Outrunning Time"]

[Text] A cobalt "ingot" costing hundreds of thousands of rubles was produced for the Anniversary of the Great October Socialist Revolution at the Noril'sk Mining-Metallurgical Combine. Such valuable metal has been additionally smelted above the plan at the enterprise since the beginning of the year.

Intertwining of many kilometers of various colored pipes and small, seemingly toy furnaces is what the chlorinated cobalt shop looks like, the most complex at the enterprise. Hydrometallurgy, chemistry and flame smelting are joined into a single unit here. The precision of all the processes is that of a jeweler. This is also confirmed by the State Badge of Quality, by which all five types of products from the shop have been noted.

"We recently completed reconstruction," says the deputy chief of the shop N. Pomolov, "which permitted us to double product output. The hydrometallurgical division now operates continuously and all processes for producing the necessary solutions are monitored automatically."

The work of the smelters here is complex, like a jeweler's work, but high professional skills permits them to outrun time. For example, V. Ivanov's brigade completed the plan of four years of the five-year plan during the pre-holiday days, becoming the winner of the shop competition in honor of the 62nd anniversary of the Great October Socialist Revolution.

During this five-year plan, Noril'sk became the main supplier of cobalt in the country. The metal is shipped from here to more than 200 addresses. [54-6521]

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USSR UDC 539.4

THE EFFECT OF TUNGSTEN CARBIDE ON THE CREEP OF ZIRCONIUM CARBIDE

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 15 No 10, Oct 79
pp 1775-1778 manuscript received 3 Aug 76

KATS, S. M., ORDAN'YAN, S. S., GORIN, A. I., SEMENOV, S. S. and KUDRYASHEVA, L. V., Leningrad Technological Institute imeni Lensovet

[Abstract] The effect of dissolved WC on the creep parameters of ZrC-base solid solutions was investigated on samples containing up to 12% WC. Samples were produced from powders under a dry pressure of 1 ton/cm^2 and then vacuum sintered at 2100°C for one hour. After sintering, the samples were annealed at 2400°C with several samples annealed at 2500-2900°C. After the samples were subjected to a compressive stress of 1-5 kG/mm^2 it was noted that the concentration relationship of creep rate had a minimum belonging to alloys containing 5-6 mol% WC which was 1/8 to 1/12 that of ZrC. The creep activation energy for temperatures up to 2800°C was 174±18 kcal/mol and was relatively independent of the amount of WC. At temperatures above 2650°C, creep was linear while at lower temperatures it was barely perceptible. Figures 3; references 9: 7 Russian, 2 Western.
[48-6368]

USSR UDC 669.3:620.18+620.17:669.721'71'5

EFFECT OF COPPER ON THE STRUCTURE AND PROPERTIES OF ALLOYS OF THE Mg-Al-Zn SYSTEM

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 10, 1979 pp 59-61

YEAHOV, A. A., LALAYAN, E. A. and SHMUYLOVICH, A. R.

[Abstract] The effect of treatment with minute amounts of copper on the structure and properties of cast alloys of the Mg-Al-Zn system was investigated. The alloys were melted in a 3-kg steel crucible within an electric laboratory furnace. Copper was added in the form of an Al-Cu master alloy containing 50% Cu. The charge was then cast into chill molds from which specimens were cut out and tested. Treatment of the alloys with up to 0.5-0.8% Cu increased their yield point by 3-5 kg/mm^2 owing to the comminution of the eutectic component (the β phase, or $Mg_{17}Al_{12}$ phase), which resulted in a fuller and more uniform saturation of the solid solution with the elements constituting the β phase during pre-quench heating. The positive effect of copper on the strength properties of alloys of the Mg-Al-Zn system is chiefly due to the action of copper as an agent promoting the dissolution of aluminum in these alloys during homogenizing. Figures 6.
[23-1386]

USSR UDC 669.293

EFFECT OF TITANIUM, ZIRCONIUM, AND CARBON ON THE HIGH-TEMPERATURE STRENGTH AND EMISSION PROPERTIES OF TUNGSTEN

Moscow IVUZ. MASHINOSTROYENIYE in Russian No 10, 1979 pp 106-109 manuscript received 13 Jul 77

ARZAMASOV, V. B.

[Abstract] The effect of alloying and temperature on the high-temperature strength and work function of tungsten alloys of the W-Ti, W-Zr, and W-Zr-C systems was investigated. It was found that treatment of tungsten with minute amounts of Ti (0.12 wt.%), Zr (0.09-0.11 wt.%) and C (≤0.05-0.010 wt.%) raises its recrystallization temperature and increases its high-temperature strength. The maximum effect is produced by joint treatment with 0.1% Zr and 0.01% C which, at 1000-1800°C, form the carbide phase ZrC resulting in a 3- to 4-fold increase in high-temperature strength compared with untreated tungsten. It is established that titanium, when added in the amount of 0.1 wt.%, has virtually no effect on the work function of tungsten. For W-Zr and W-Zr-C alloys at 1700-1900°C emission from cathodic surfaces is similar to emission of materials with low work function. At ≳ 1800-1900°C emission comes close to the emission of the pure substrate material, since the activating zirconium film gets vaporized from the cathodic surface. Figures 3; references 5 (Russian).
[18-1386]

USSR UDC 669.35

EFFECT OF THE STRUCTURAL FACTOR ON STRESS RELAXATION IN COPPER ALLOYS

Moscow IVUZ. MASHINOSTROYENIYE in Russian No 10, 1979 pp 114-118 manuscript received 30 Jan 78

TKHAGAPSOYEV, KH. G. and TSAGOV, KH. A.

[Abstract] Moderately loaded flexible components are often liable to failure owing to stress relaxation following their hardening. Hence relaxation resistance (RR) is a factor to be considered in order to reduce risk in the selection of materials and in hardening techniques. In this connection the effect of work hardening on the RR was investigated with respect to the copper-based spring alloys BrOF6.5-0.15, BrOTs4-3, BrKMts-3-1, MNTs15-20, BrB2, and BrBNT1.9, which are widely used in the manufacture of flexible components of machinery and instruments. The product of the temperature modulus of elasticity and the elastic limit was used as the criterion of RR. In these terms, the maximum RR was displayed by beryllium bronze BrB2 and the minimum, by silicon-manganese bronze BrKMts3-1. Figures 2; references 3 (Russian).
[18-1386]

USSR UDC 535.211

ON THE EVALUATION OF DECREASING THE INTENSITY OF PLASMA LASER RADIATION NEAR THE SURFACE OF SOLID TARGETS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 5, Sep-Oct 79 pp 3-6 manuscript received 1 Mar 78

UGLOV, A. A. and GNEDOVETS, A. G., Moscow

[Abstract] A study was made of the weakening of laser radiation intensity caused by refraction and absorption of a laser beam by a plasma formed near the surface of a solid target. The effect of electron density distribution, dimensions and propagation of the plasma sheaf by the laser beam on the characteristics of the heat source acting on the irradiated target surface was evaluated. The regions of charge of electron concentration and their gradients were determined in the limits of which the mechanisms of refraction and absorption of laser radiation by the plasma cloud act. Figures 2: references 3: 2 Russian, 1 Western. [25-6368]

USSR UDC 539.216.2:537.52

FEATURES OF METALLIC FILM ACICULAR STRUCTURE DURING ELECTRON-BEAM PLASMA SPRAYING

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 5, Sep-Oct 79 pp 51-55 manuscript received 18 Dec 78

GUSEV, O. V., ROSLYAKOVA, T. L. and SHORSHOROV, M. KH., Moscow

[Abstract] The method of transmission electron microscopy was used to investigate the features of acicular structure of silver and aluminum films on KCl and Si substrates during electron-beam plasma spraying (EBPS) using an accelerating potential of -1.5 kV. The high energy of neutral atoms and the presence of high-energy ions in the vapor flow during EBPS promotes a significant lowering of the epitaxial film-growth temperature on alkaline-haloid crystals in comparison with thermal vaporization. Silver films, condensing on the KCl chips, revealed a well expressed epitaxial orientation $(001)_{Ag}//(001)_{KCl}$ even without preheating of the substrate, whereas in the earliest stages of condensation the process of coalescence occurs, leading to diminished acicular density and increased acicular size. On a silicon substrate the silver film has a primarily $(111)_{Ag}//(111)_{Si}$ orientation, being azimuthally

disoriented from the point of epitaxial orientation and the acicular density is four times greater than on KCl. Aluminum films, sprayed on Si at room temperature to a thickness of 20Å, are continuous with a highly dispersed structure and no primary orientation. Figures 5; references 7: 6 Russian, 1 Western.
[25-6368]

USSR UDC 621.746:669.111.2

ANOMALOUS GRAPHITE IN CASTINGS OF HIGH-MAGNESIUM GRAY IRON: REPORT 2

Moscow IVUZ: CHERNAYA METALLURGIYA in Russian No 9, Sep 79 pp 112-114
manuscript received 21 [illegible] 78

VORONTSOV, [illegible]. I., BESP[illegible], N. S. and MIKHAYLOV, A. M., Moscow Institute of Steel and Alloys

[Abstract] A solution is still sought to the problem of producing large castings of high-magnesium gray iron with stabilized globular rather than anomaloys vermicular graphite at the center. Experimental studies concerning this problem include controlled melting and subsequent oriented crystallization with graphite in either form. Here globular and vermicular graphite were produced by holding the melt at 1340-1400°C for 5 minutes and 40 minutes respectively. The area of the graphite-austenite interface, per unit volume of graphite, was determined by microscope measurements and calculations. An analysis of the casting process and examination of the microstructure indicate that anomalous graphite structures form in hot spots of a casting due to changes in the crystallization rate which do not allow sufficient time for carbon migration and due to the reduced effectiveness of graphitizing-spheroidizing additives. It appears necessary to provide more graphite nucleation centers during both the initial and the final stages of the crystallization process, namely by using modifying additions capable of remaining active for longer periods of time. Figures 2; references 4: 3 Russian, 1 Western.
[50-2415]

USSR UDC 669.018.2:620.17

EFFECT OF DEFORMATION ON THE PHYSICO-MECHANICAL PROPERTIES OF INVAR

Moscow IVUZ: CHERNAYA METALLURGIYA in Russian No 9, Sep 79 pp 106-108
manuscript received 4 May 79

BASHNIN, YU. A., ULANOVSKIY, F. B. and SHIRYAYEVA, A. N., Moscow Evening Metallurgical Institute

[Abstract] A study was made to determine the effect of cold working on the temperature coefficient of linear thermal expansion and on some mechanical properties characterizing invar, an iron-nickel alloy used as the passive component of bimetals. Grade 36N invar has the minimum thermal expansivity after quenching from 830°C in water with subsequent tempering for 1 hour at 315°C and aging for 48 hours at 95°C. Specimens with 35, 36, and 37% Ni respectively, within the applicable GOST specifications, were tested at room temperature for tensile strength, 0.2% yield strength and Brinell hardness after cold rolling with various levels of deformation from 20 to 80%. All mechanical properties were found to improve with increasing deformation, regardless of the nickel content but most appreciably in the case of the 37% Ni alloy. The temperature coefficient of linear thermal expansion was found to depend also on the temperature range and, on this basis, the 36% Ni alloy loses its invar properties at temperatures above 250°C. Figures 1; references 2 (Russian).
[50-2415]

USSR UDC 620.181

FEATURES OF THE EFFECT OF HIGH-TEMPERATURE DEFORMATION ON THE KINETICS OF BAINITE TRANSFORMATION IN STEEL OF VARIOUS COMPOSITION

Moscow IVUZ: CHERNAYA METALLURGIYA in Russian No 9, Sep 79 pp 101-105
manuscript received 24 Oct 78

KHLESTOV, V. M., GOTSULYAK, A. A., ENTIN, R. I., KONOPLEVA, YE. V. and KOGAN, L. I., Zhdanov Institute of Metallurgy

[Abstract] A study was made concerning the anomalous effects of hot rolling, at 800°C after heating to 950°C, on the kinetics of bainite transformation in steel. Eight grades of steel were considered in the experiment, differing either in the carbon content only (0.1-0.4%) or also in the alloying elements (nickel, chromium, molybdenum). The results indicate that hot rolling can either inhibit or accelerate subsequent bainite transformation. A lower temperature of isothermal heat

treatment, a higher carbon content, and addition of carbide-forming elements will inhibit it. Activation of grain nucleation processes, possibly stimulated by large distortions of the non-uniform carbon concentration profile, will accelerate it. Figures 2; references 12 (Russian).
[50-2415]

USSR UDC 621.791.76

A STUDY OF THE INTERACTION OF IRON AND TITANIUM UNDER A PULSE LOAD

Moscow IVUZ: CHERNAYA METALLURGIYA in Russian No 9, Sep 79 pp 92-94
manuscript received 7 Jun 78

RYABCHIKOV, YE. A., RYABCHENKO, T. G., SOLOV'YEV, V. YA. and EPSHTEYN, G. N., Moscow Institute of Steel and Alloys

[Abstract] A study was made to determine the structure of the transition layer in iron-titanium bimetal strips formed during impact welding. The physical process parameters influencing that structure include impact time and peak pressure at the shock wave front. Welding was done in the parallel configuration, with the bottom strip on the sand base and the top strip dropped upon detonation of an explosive charge of ammonite mix. Subsequent metallographic examination, after heat treatment or service, covered the "white" phase consisting of two intermetallic compounds: FeTi and Fe_2Ti. The depth of iron penetration and the iron distribution in titanium were determined on the basis of x-ray microspectrographic measurements and x-ray structural analysis, following a vacuum anneal of specimens at temperatures from 750 to 1050°C. Figures 3; references 2 (Russian).
[50-2415]

USSR UDC 669.017.3

MORPHOLOGICAL ANOMALIES OF CARBURIZED IRON ALLOYS

Moscow IVUZ: CHERNAYA METALLURGIYA in Russian No 8, Aug 79 pp 92-95
manuscript received 23 Feb 79

MOVCHAN, V. I., PEDAN, L. G. and GERASIMENKO, V. P., Dnepropetrovsk Institute of Metallurgy

[Abstract] A study of carburized iron alloys with α-phase producing carbide forming elements (molybdenum, tungsten, vanadium, chromium, titanium), was made for the purpose of determining the effect of various

factors on the structurization during the 3-phase reaction of ferrite breakup into austenite and carbides. In the case of normal breakup with a compatible growth of austenite and carbide grains in plastic bacillary clusters, a higher alloy content widened the temperature range of such growth but also required a higher carburization temperature. Anomalous breakup inhibited compatible growth and produced disperse structures of carbide inclusions. The structurization also depended on the initial carbon content and the carburization temperature, a compatible cluster structure being formed, typically, during carburization at 1100°C to increase the initial carbon content to 0.05%. Figures 4; references 2 (Russian).
[51-2415]

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